

(19) World Intellectual Property Organization  
International Bureau



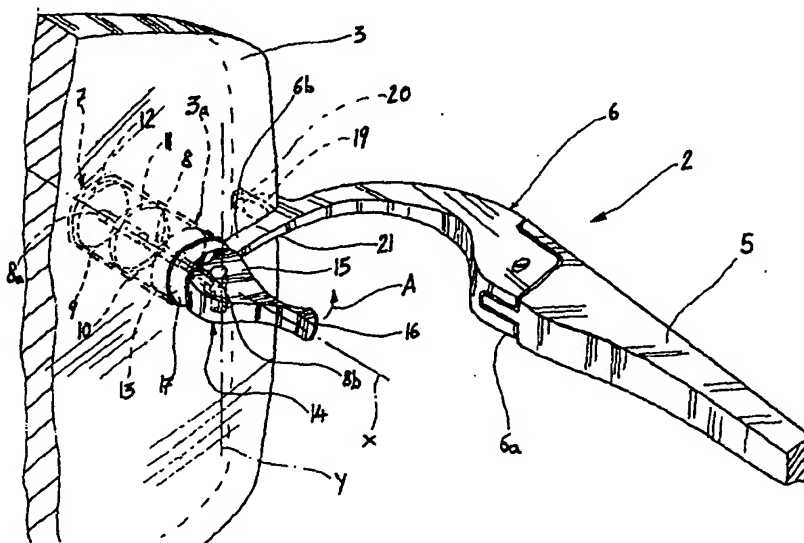
(43) International Publication Date  
11 April 2002 (11.04.2002)

PCT

(10) International Publication Number  
**WO 02/29474 A1**

- (51) International Patent Classification<sup>7</sup>: G02C 1/02 (81) Designated States (*national*): AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
- (21) International Application Number: PCT/IT00/00397
- (22) International Filing Date: 4 October 2000 (04.10.2000)
- (25) Filing Language: Italian
- (26) Publication Language: English
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
- (71) Applicant (*for all designated States except US*): SAFILO SOCIETA' AZIONARIA FABBRICA ITALIANA LAVORAZIONE OCCHIALI S.p.A [IT/IT]; Piazza Tiziano, 7, I-32044 Pieve di Cadore (IT).
- (72) Inventor; and
- (75) Inventor/Applicant (*for US only*): TABACCHI, Vittorio [IT/IT]; Piazza Tiziano, 7, I-32044 Pieve di Cadore (IT).
- (74) Agent: CANTALUPPI, Stefano; Jacobacci & Partners S.p.A., Via Berchet 9, I-35131 Padova (IT).
- Published:  
— with international search report
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: IMPROVED SPECTACLES



(57) Abstract: Improved spectacles comprise a frame (2), at least one lens (3), and a fixing device (7) for fixing by means of expansion the lens to an element (4, 6) of the frame. The fixing device (7) is fixed to the element (4, 6) of the frame and is engaged by expansion in a hole (3a) in the lens so as to fix the lens to the element and comprises a tension rod (8) and at least one sleeve (9, 10) fitted coaxially on the tension rod, expandable radially as a result of axial compression, and disposed between abutment means (12, 13). The fixing device (7) comprises actuator means (14) associated with the tension rod (8) for compressing the at least one sleeve (9, 10) between the abutment means (12, 13).

WO 02/29474 A1

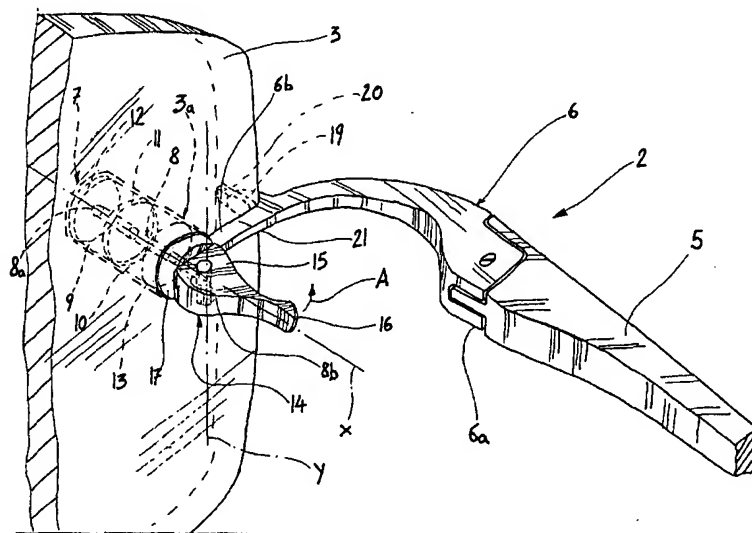


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1

**(10) International Publication Number**  
**WO 02/29474 A1**

WO 02/29474 A1

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*



**(57) Abstract:** Improved spectacles comprise a frame (2), at least one lens (3), and a fixing device (7) for fixing by means of expansion the lens to an element (4, 6) of the frame. The fixing device (7) is fixed to the element (4, 6) of the frame and is engaged by expansion in a hole (3a) in the lens so as to fix the lens to the element and comprises a tension rod (8) and at least one sleeve (9, 10) fitted coaxially on the tension rod, expandable radially as a result of axial compression, and disposed between abutment means (12, 12). The fixing device (7) comprises actuator means (14) associated with the tension rod (8) for compressing the at least one sleeve (9, 10) between the abutment means (12, 13).

**WO 02/29474 A1**

## Improved spectacles

Technical field

The subject of the present invention is improved spectacles according to the preamble to the main claim.

5 Background art

Within the technical field to which the invention relates, the need to provide spectacles which permit a firm lens/frame coupling and which at the same time have a light and attractive appearance is known.

10 For example, it is known from United States patent No. 6007200 to produce spectacles in which the fixing device between the lens and the frame comprises a sleeve made of plastics material which is housed in a hole in the lens and in which an appendage of the frame is inserted.

15 The sleeve typically has an inside diameter slightly smaller than the outside diameter of the appendage so that, when the appendage is inserted in the sleeve, the sleeve is expanded radially against the internal surface of the hole, keeping the lens and the frame firmly coupled.

20 However, spectacles which use fixing devices of this type have many disadvantages.

First of all these spectacles are ill-suited to any subsequent operations to replace the lenses; in fact the lens is disconnected from the frame by the removal of the  
25 appendage from the hole in opposition to the restraining action exerted by the sleeve. It can easily be seen that, in spectacles with fixing devices of this type, the ease with which the appendage can be removed from the hole in order to disconnect the lens is correlated inversely with  
30 the effectiveness of the restraining action, and it is

therefore impossible to improve one of the two functions without adversely affecting the other.

A second disadvantage of these spectacles is that, since the deformation of the sleeve is of plastic type, the removal of the appendage from the hole may necessitate replacement of the sleeve.

A further limitation encountered in these spectacles is that the sleeve is provided as a component which is separate both from the lens and from the frame and, in view of its very small dimensions, it is therefore awkward to fit and subject to being lost.

The problem upon which the present invention is based is that of providing improved spectacles which are designed structurally and functionally to overcome the limitations explained above with reference to the prior art mentioned.

#### Disclosure of the invention

This problem is solved by the present invention by means of spectacles formed in accordance with the appended claims.

#### Brief description of the drawings

The characteristics and the advantages of the invention will become clearer from the detailed description of a preferred embodiment thereof, illustrated by way of non-limiting example with reference to the appended drawings, in which:

- Figure 1 is a perspective view of a pair of spectacles formed in accordance with the present invention,
- Figures 2 and 3 are perspective views of a first detail and of a second detail of the spectacles of Figure 1, on an enlarged scale, and

- Figure 4 shows the detail of Figure 2 in section, and on an enlarged scale.

Best mode for carrying out the invention

In the drawings, a pair of spectacles formed in accordance with the present invention is generally indicated 1.

The spectacles 1 comprise a frame 2 and a pair of lenses 3.

Typically identified on the frame 2 are a bridge 4 extending between the lenses 3, shoulders 6 fixed to the lenses 3 on the sides remote from the bridge 4, and arms 5 each articulated to an end 6a of a respective shoulder 6.

The lenses 3 are connected to one or more elements of the frame 2 (in the preferred embodiment described herein, to the bridge 4 and to the shoulders 6) by means of fixing devices 7. The fixing devices 7 are provided at the free ends of the bridge 4 and of the shoulders 6 (indicated 4a and 6b, respectively) in order to be inserted in suitable holes 3a in the lenses 3.

According to the present invention, each fixing device 7 comprises a tension rod 8 which has an axis X and onto which are fitted coaxially a first sleeve 9 and a second sleeve 10 and a Belleville washer 11 interposed between the sleeves.

The sleeves 9 and 10 are included axially between a first flange 12 fixed to a first end 8a of the tension rod 8 and a second flange 13 slidable axially on the tension rod 8.

Moreover, the sleeves 9 and 10 are made of elastomeric material and can therefore expand radially when they are compressed axially. The Belleville washer 11 interposed

between the sleeves 9, 10 is also susceptible to similar behaviour when subjected to axial compression.

The fixing device 7 also comprises actuator means 14 connected to a second, opposite end 8b of the tension rod 8.

5 The actuator means 14 comprise a cam 15 articulated to the end 8b of the tension rod 8 and pivotable about an axis Y by means of an operating lever 16. The operating lever 16 is pivotable about the axis Y between a rest position shown in Figure 2 and an operative position in which the tension rod

10 8 is translated axially towards the actuator means 14 by the effect of the cam 15.

Each fixing device 7 is connected to a respective end 4a of the bridge 4 or to an end 6b of a respective shoulder 6 by means of a drilled plate 17 which is interposed between

15 the second flange 13 and the cam 15 and through which the tension rod 8 extends slidably.

With reference to Figure 2, a tooth 19 for the abutment of the lens 3 extends from each shoulder 6 and is preferably housed in a recess 20 formed in the peripheral edge of the

20 lens 3 so as to serve as a means for preventing rotation of the lens 3, preventing it from pivoting about the axis X.

A rotation prevention means of this type may similarly be provided on the bridge 4 (see Figure 3).

The mounting of the lens 3 on the frame 2 requires each

25 fixing device 7 associated with an element of the frame 2 (in the preferred embodiment described herein, with the bridge 4 and with the shoulders 6) to be inserted in the respective hole 3a in the lens 3.

The fixing device 7 is inserted with the operating

30 lever 16 in the rest position and with the lens 3 positioned angularly in a manner such that the tooth 19 of the shoulder

6 (or of the bridge 4) is housed in the corresponding recess  
20 of the lens 3.

It will be noted that the lens 3 is advantageously in  
abutment with a portion 21 of the shoulder 6 (or of the  
5 bridge) disposed between the drilled plate 17 and the tooth  
19 and that, upon completion of the insertion, the first and  
second flanges 12, 13 are in the hole 3a, substantially  
flush with the lens 3.

The operating lever 16 is then pivoted about the axis Y  
10 in the direction indicated by the arrow A in Figure 2 so  
that the tension rod 8 and the first flange 12 fixed thereto  
are translated along the axis X relative to the second  
flange 13 and the drilled plate 17, owing to the effect of  
the cam 15.

15 The sleeves 9, 10 and the Belleville washer 11 are thus  
compressed axially by the flanges 12, 13 and, by virtue of  
their resilient characteristics, are consequently expanded  
radially against the internal surface of the hole 3a. It  
will be noted that, by virtue of the at least partial  
20 presence of the flanges 12 and 13 in the hole 3a, the  
expansion of the sleeves 9, 10 is guided and contained  
within the hole 3a, without undesired external bulging.

In order to disconnect the lens 3 from the frame 2, it  
suffices to pivot the operating lever 16 in the opposite  
25 direction, to the original rest position. The sleeves 9, 10  
and the Belleville washer 11 are thus returned to the  
radially contracted condition and the fixing device 7 can  
easily be withdrawn from the hole 3a.

It will also be noted that, by virtue of the provision  
30 of the actuator means 14 for controlling the radial  
expansion of the sleeves 9, 10 and of the Belleville washer



11, the restraint of the lens is advantageously rendered unconnected with the relative dimensions of the fixing device 7 and of the hole 3a. The operations to insert and remove the fixing device 7 can thus be carried out easily  
5 without adversely affecting the lens/frame coupling.

The invention thus solves the problem posed, at the same time offering many further advantages, amongst which is simplified control of the operations to mount and remove the lens, due to the fact that the fixing device is already  
10 connected to the frame and there are no separate elements such as screws or sleeves which are liable to be lost.

Moreover, with the present invention, the above-mentioned operations can take place quickly and safely and are completely reversible.

## CLAIMS

1. Improved spectacles comprising a frame (2), at least one lens (3), and a fixing device (7) for fixing by means of expansion the lens to an element (4, 6) of the frame, the  
5 fixing device (7) being fixed to the element (4, 6) and engaged by expansion in a hole (3a) in the lens in order to fix the lens to the element, characterized in that the fixing device comprises a tension rod (8), at least one sleeve (9, 10) fitted coaxially on the tension rod and  
10 disposed between abutment means (12, 13), the sleeve being radially expandable as a result of axial compression, and actuator means (14) associated with the tension rod (8) for compressing the at least one sleeve (9, 10) between the abutment means (12, 13).
- 15 2. Spectacles according to Claim 1 in which the abutment means comprise a pair of flanges (12, 13) facing one another axially along the tension rod (8).
3. Spectacles according to Claim 1 or Claim 2 in which the actuator means (14) comprise a cam (15) connected to the  
20 tension rod (8) and pivotable about an articulation axis (Y) by means of an operating lever (16).
4. Spectacles according to Claim 3 in which the cam (15) is articulated to one end (8b) of the tension rod.
5. Spectacles according to Claim 3 or Claim 4 in which  
25 the cam (15) is abutted by one of the flanges (13) which is slidable axially on the tension rod (8) on one side of the at least one sleeve (9, 10), and the other flange (12) is fixed axially to the tension rod (8) on the opposite side of the at least one sleeve (9, 10).
- 30 6. Spectacles according to one or more of Claims 2 to 5 in which, when the device (7) is inserted in the hole (3a)

in the lens (3), the flanges (12, 13) are at least partially housed in the hole in order to guide and contain the radial expansion of the at least one sleeve (9, 10) inside the hole.

5        7. Spectacles according to one or more of the preceding claims in which the at least one sleeve (9, 10) is made of elastomeric material.

8. Spectacles according to one or more of the preceding claims in which the fixing device comprises at least two  
10 axially adjacent sleeves (9, 10) between which at least one Belleville washer (11) is interposed.

9. Spectacles according to one or more of the preceding claims in which the fixing device (7) is connected to the frame element (4, 6) owing to the provision of a drilled  
15 plate (17) of the element, in which the tension rod (8) is slidably restrained.

10. Spectacles according to Claim 9 in which the drilled plate (17) is interposed between the cam (15) and the flange (13) which is slidable axially on the tension rod  
20 (8).

11. Spectacles according to one or more of the preceding claims in which a tooth (19) for the abutment of the lens (3) extends from the frame element (4, 6) in order to oppose pivoting of the lens about the axis (X) of the  
25 tension rod (8).

12. Spectacles according to Claim 11 in which the abutment tooth (19) can be housed in a recess (20) formed along the peripheral edge of the lens (3).

13. Spectacles according to one or more of the preceding claims in which the frame element is a shoulder  
30 (6) of the spectacles.

14. Spectacles according to one or more of the preceding claims in which the frame element is a bridge (4) between the lenses (3) of the spectacles.

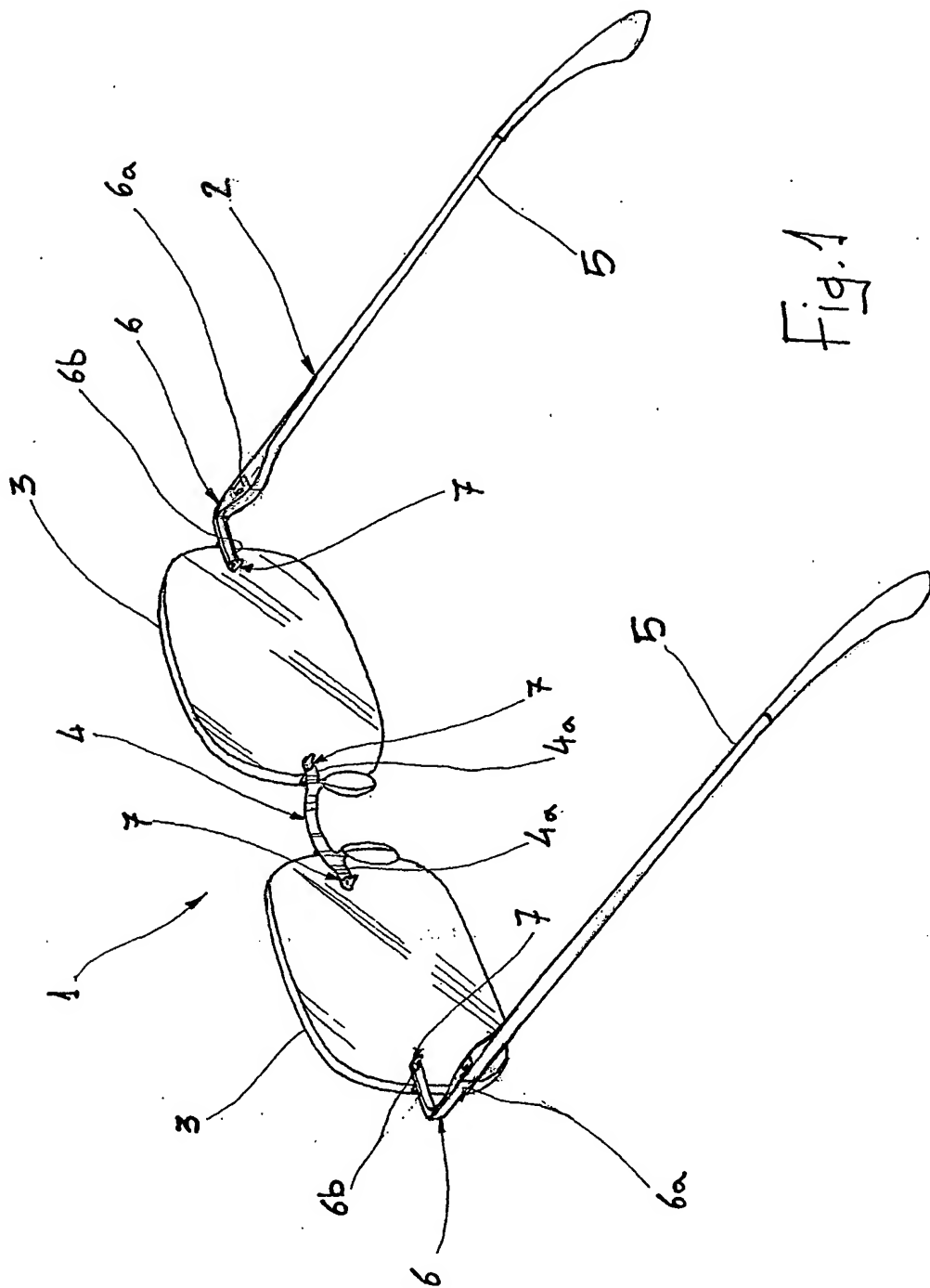


Fig. 1

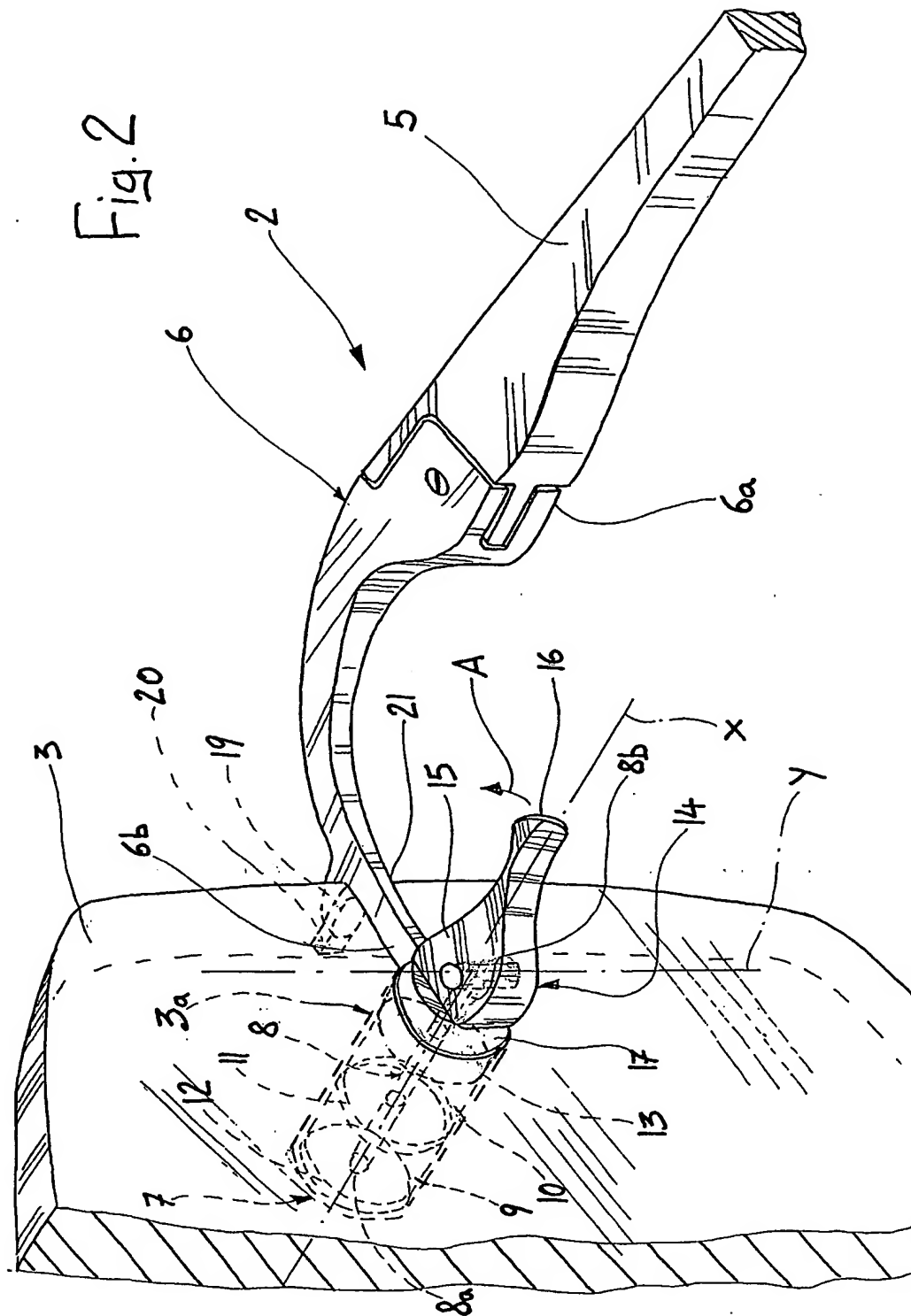
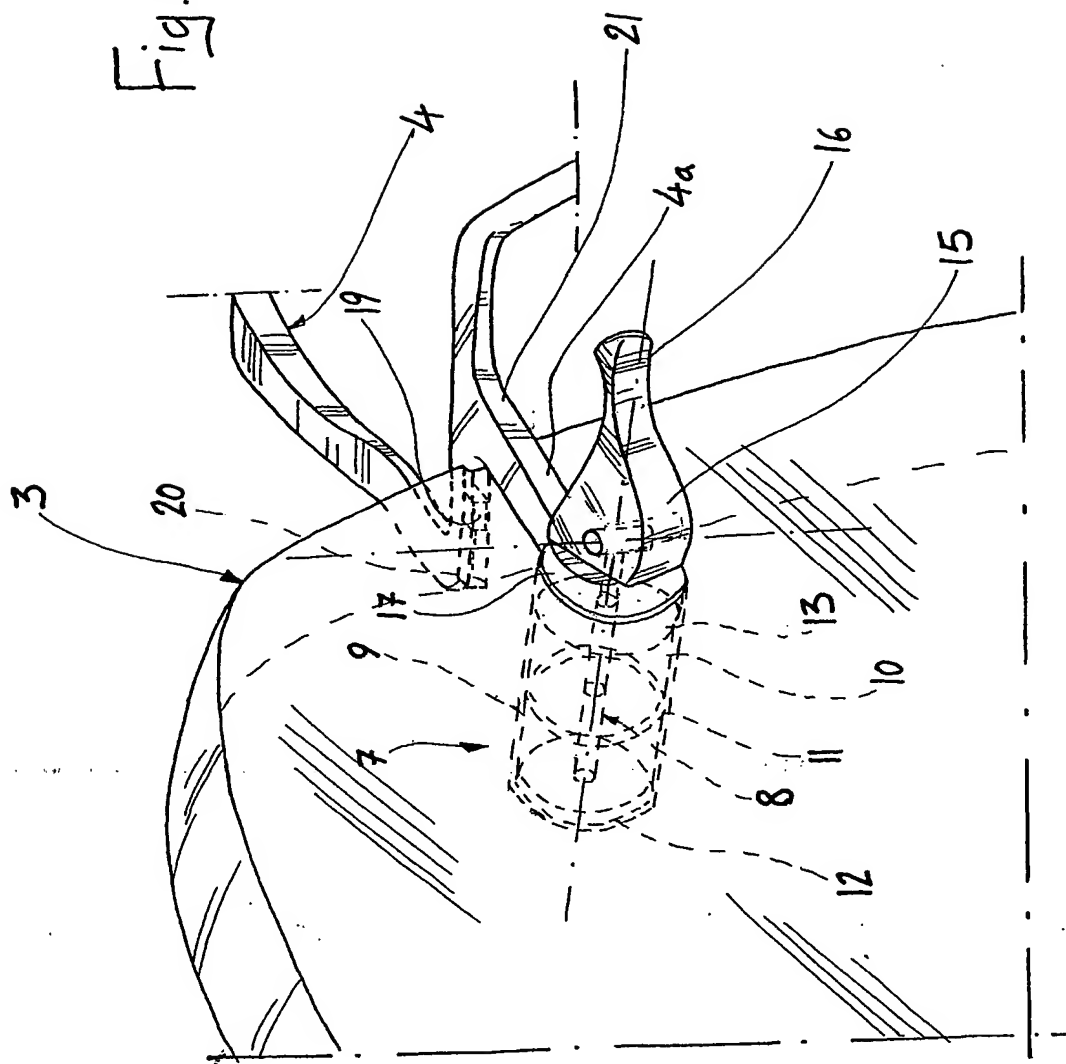
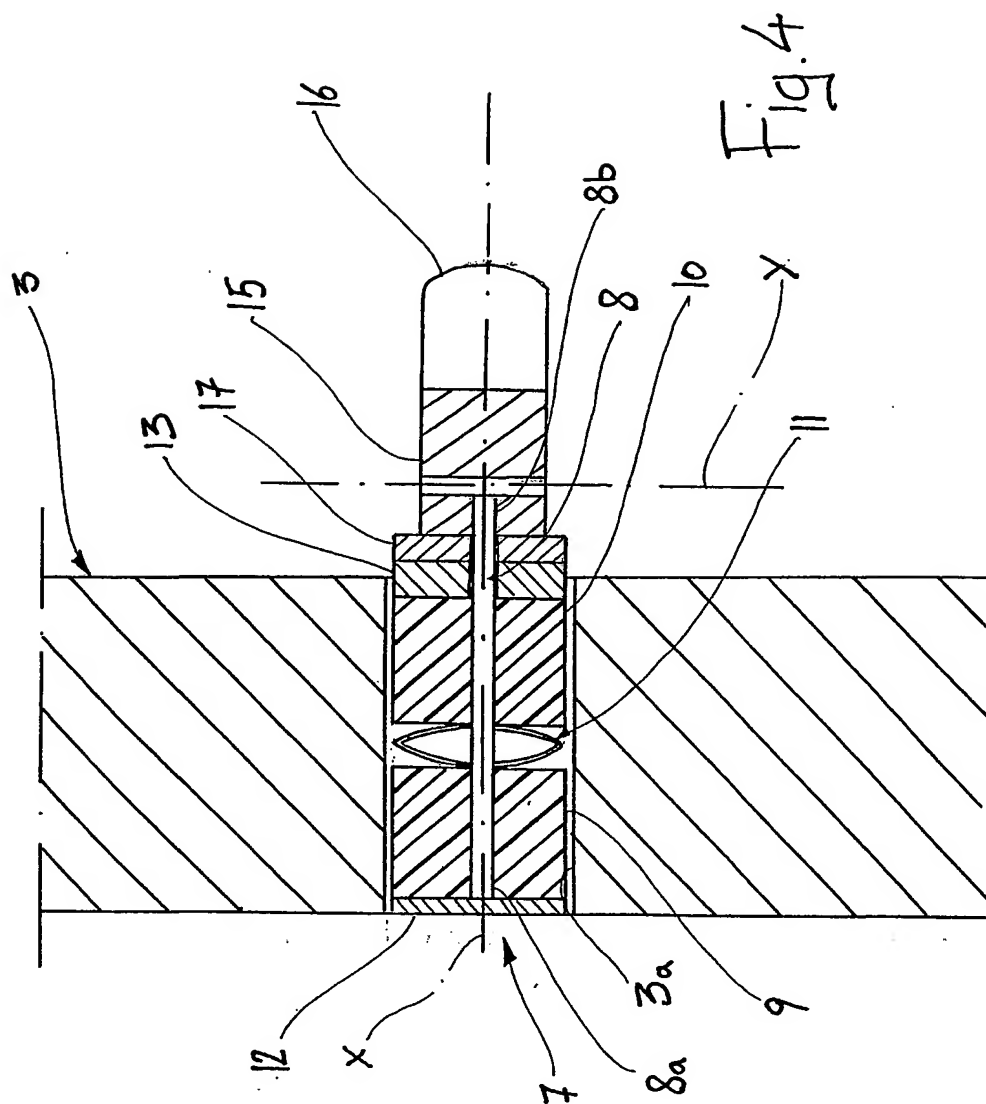


Fig. 3







## INTERNATIONAL SEARCH REPORT

Intern	Application No
PCT/11	00/00397

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 G02C1/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 G02C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 42 17 908 C (OPTISCHE WERKE G. RODENSTOCK) 21 January 1993 (1993-01-21) abstract; claims	1,13,14
A	US 6 024 445 A (CONNER BRIAN N ET AL) 15 February 2000 (2000-02-15) column 5, line 29 -column 6	1,11-14
A	US 6 007 200 A (TACHIBANA HIDEAKI) 28 December 1999 (1999-12-28) cited in the application claims	1,13,14
A	EP 0 724 178 A (MASUNAGA OPTICAL MFG CO LTD) 31 July 1996 (1996-07-31) column 4, line 12 -column 5, line 7; claims	1,11-14

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*G\* document member of the same patent family

Date of the actual completion of the international search

27 April 2001

Date of mailing of the international search report

07/05/2001

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

CALLEWAERT, H

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IT 00/00397

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
DE 4217908	C	21-01-1993	NONE	
US 6024445	A	15-02-2000	AU 1450100 A WO 0026716 A	22-05-2000 11-05-2000
US 6007200	A	28-12-1999	NONE	
EP 0724178	A	31-07-1996	AT 184997 T CH 689407 A DE 69420858 D DE 69420858 T WO 9605535 A US 5585870 A	15-10-1999 31-03-1999 28-10-1999 20-04-2000 22-02-1996 17-12-1996

**(57) Abstract:** Improved spectacles (1) comprise a frame (2), at least one lens (3), and fixing means and complementary fixing means for fixing the lens to at least one element (4) of the frame, in which the fixing means include a first appendage (5) which is fixed to the frame element (4) and can be housed in a through-hole (7) of the lens. The fixing means further comprise at least one second appendage (6), fixed to the frame element (4) and spaced from the first appendage (5), and the complementary fixing means comprise respective seats (11, 36, 37) for housing the appendages (5, 6), the seats being fixed together in order to restrain the appendages (5, 6) on the side of the lens (3) remote from the frame element (4).



---

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

Improved spectacles, particularly of the type with a lightweight frame

Technical field

The present invention relates to improved spectacles,  
5 particularly of the type with a lightweight frame, according to the preamble to the main claim.

Background art

The invention is applicable, in particular but not exclusively, to the technical field defined by spectacles  
10 with so-called "rimless" frames, in which the spectacle lenses are fixed directly to frame elements such as the shoulders and the bridge without the interposition of lens-holding rims.

In this field, in order to make the frame as light as  
15 possible, there is a need to produce these frame elements with particularly small cross-sections. However, this conflicts with the further requirement at the same time to ensure effective coupling with the lenses and adequate durability of the frame.

20 The problem upon which the present invention is based is that of providing improved spectacles, particularly with a lightweight frame, which are designed structurally and functionally to fulfil the requirements set out above with reference to the prior art mentioned.

25 Within the scope of this problem, a first object of the invention is to provide spectacles in which screw means, which would adversely affect the overall aesthetic impact of the spectacles, are not required for fixing the lenses to the frame.

30 A second object of the invention is to provide an arrangement which can be used effectively both on metal

frames and on frames made of plastics material.

A third object of the invention is to provide spectacles in which the coupling between lens and frame can also be temporary, facilitating removal of the lens.

5 Disclosure of the invention

This problem is solved and these objects are achieved by the present invention by means of spectacles formed in accordance with the appended claims.

Brief description of the drawings

10 The characteristics and advantages of the invention will become clearer from the detailed description of a preferred embodiment thereof described by way of non-limiting example with reference to the appended drawings, in which:

- 15 - Figure 1 is a partial perspective view of spectacles formed in accordance with the present invention,
- Figure 2 is a partial section through the spectacles of Figure 1,
- Figure 3 is a side elevational view showing a first  
20 element of the spectacles of Figure 1, on an enlarged scale and in the condition prior to assembly,
- Figure 4 is a side elevational view showing a second element of the spectacles of Figure 1, on an enlarged scale,
- Figure 5 shows a variant of the element of Figure 3,
- 25 - Figure 6 is a perspective view of a variant of a detail of Figure 1,
- Figure 7 is a partial plan view of a second embodiment of spectacles according to the present invention,
- Figures 8 and 9 are a plan view and a side elevational  
30 view, respectively, showing a first element of the spectacles of Figure 7 on an enlarged scale,

- Figure 10 is a front elevational view of a second element of the spectacles of Figure 7,
- Figure 11 is a partial plan view of a third embodiment of spectacles according to the present invention,
- 5 - Figure 12 is a front elevational view showing an element of the spectacles of Figure 11, on an enlarged scale.

Best mode for carrying out the invention

With reference initially to Figures 1 to 6, improved spectacles formed in accordance with the present invention  
10 are generally indicated 1.

The spectacles 1 comprise a frame 2 on which lenses 3 are mounted.

The frame 2 is made of wire with a thin cross-section, preferably titanium wire, so as to provide the spectacles 1  
15 with the desired lightweight characteristics.

Moreover, the frame 2 is of the "rimless" type and the lenses 3 are fixed directly to a frame element, generally indicated 4. In the drawings, the frame element 4 is represented by a shoulder of the frame but the following  
20 remarks are also applicable in exactly the same way to the fixing of the lens 3 to the bridge of the frame.

An arm 4a, defined on the frame element 4, extends close to a principal surface 3a of the lens 3, defined as the surface of the lens remote from the user's face in the  
25 conditions of use of the spectacles. The arm 4a extends along an axis X substantially parallel to the principal surface 3a.

The spectacles 1 have fixing means and complementary fixing means for fixing the lens 3 by connecting it to the  
30 frame element 4 in the manner described in detail below.

The fixing means comprise a first appendage 5 and a

second appendage 6 which are fixed to the frame element 4 and can be housed with clearance in respective through-holes 7 and 8 opening in the lens 3.

The appendage 5 and 6 are cylindrical in shape and extend parallel to one another and in the same direction from the free end of the arm 4a.

In this first preferred embodiment, the appendages 5 and 6 correspond to the end regions of a "C"-shaped element 9 which is also made of wire and may be fixed alternatively, either transversely astride the free end of the arm 4a (Figures 1 and 2) or parallel to and bearing on the arm 4a (Figure 6).

In the first case, the appendages 5 and 6 extend from the frame element 4 in a manner such that the plane they define is substantially perpendicular to the axis X along which the arm 4a extends, thus also constituting effective means for preventing rotation of the lens 3 about the arm 4a.

In the second case, the "C"-shaped element 9 and the frame element 4 are arranged relative to one another in a manner such that the central portion of the "C"-shaped element 9 is parallel to and superimposed on the arm 4a. The plane defined by the appendages 5 and 6 is thus parallel to the axis X.

The above-mentioned complementary fixing means comprise respective bush-like elements 10 of longitudinal axis Y each defining a coaxial seat 11 which is open at a first end 12 of the bush-like element 10.

The bush-like elements 10 can house the appendages 5, 6 axially in the respective seats 11 and are also advantageously of a size such as to be housed in turn in the



through-holes 7 and 8 of the lens 3 and to take up the clearance between these holes and the appendages 5 and 6.

When the appendages 5, 6 are housed in a coupled condition in the seats 11, the respective first ends 12 of the bush-like elements 10 are substantially flush with the principal surface 3a of the lens 3.

According to a principal characteristic of the invention, the bush-like elements 10 are advantageously fixed together by means of a bridge portion 13 extending in the region of their ends remote from the first ends 12.

Moreover, the bush-like elements 10 are preferably made of plastics material and the respective seats 11 have cross-sections of a diameter slightly less than that of the appendages 5, 6 so that the appendages are fitted in the respective seats with interference.

With reference to the above-mentioned coupled condition, respective mutually facing curved surfaces 5a, 6a, and 11a are defined on the appendages 5, 6 and in the seats 11.

Anchoring means provided for restraining the appendages 5 and 6 in the respective seats 11 comprise projections 14 formed on the curved surfaces 5a, 6a of the appendages 5, 6.

The projections 14 advantageously extend helically on the curved surfaces 5a and 6a so as to define a screw thread of the appendages 5 and 6, the purpose of which will become clearer from the following description.

The fitting of the lens 3 on the frame element 4 involves a first step in which the bush-like elements 10 are inserted in the through-holes 7, 8 of the lens 3 from the side remote from the principal surface 3a until the bridge portion 13 abuts the lens 3.

The bush-like elements 10 extend longitudinally to a considerable extent (see Figure 3) so as to project from the principal surface 3a, even with fairly thick lenses. The portions of the bush-like elements 10 which project from the lens 3 are then cut off so that the respective first ends 12 are flush with the principal surface 3a.

The appendages 5,6 of the frame element 4 are then introduced axially into the seats 11 from the first ends 12 until the arm 4a abuts the principal surface 3a of the lens 3. Owing to the interference fit between the appendages 5, 6 and the respective seats 11, the curved surfaces 11a are expanded against the lens 3, thus simultaneously restraining the bush-like elements in the holes 7 and 8 and the appendages 5, 6 in the respective seats 11.

The restraint of the appendages 5, 6 in the seats 11 is also further ensured by the anchoring action performed by the projections 14 on the curved surface 11a which undergoes plastic deformation and is also incised and scratched.

According to a principal characteristic of the invention, the firmness of the fixing of the lens 3 to the frame element 4 is advantageously increased by the provision of the bridge portion 13 which, by firmly connecting the bush-like elements 10, constitutes an effective restraint both against movement of the lens 3 away from the arm 4a and against pivoting of the lens 3 about the arm 4a.

In both cases, the forces exerted on the lens (or on the arm 4a) are in fact translated into stresses tending to pull the appendages 5, 6 out of the respective seats 11. However, these stresses are effectively withstood by the bridge portion 13.

Figure 5 shows bush-like elements 20 formed in

accordance with a variant of the bush-like elements 10 of the previous example. Each bush-like element 20 has, at its end remote from the first end 22, a head 21 of polygonal cross-section which can be engaged by an external spanner.

5        It should be noted that both the bush-like elements 20 and the bush-like elements 10 may be axially open at the end remote from the respective first end 22, 12 so that, with thin lenses, the appendages 5 and 6 can project from the bush-like elements 10 (Figures 1 and 2).

10       The bush-like elements 20 can advantageously be used instead of the bush-like elements 10 when the spectacles 1 are assembled with a temporary lens 3, typically when they are supplied to an optician.

      In this case, the operation to remove lens 3 from the  
15 frame element 4 is easier than in the previous embodiment, in which this operation had to be performed by forced axial removal of the appendages 5, 6 from the seats 11.

      The provision of the driving head 21 in fact enables each bush-like element 20 to be unscrewed after the bridge  
20 portion 13 has been cut off. By virtue of the fact that the projections 14 are arranged helically in the manner of screw threads and are made of a harder material than the curved surface 11a and because of the rotation imparted to the bush-like element 20 by the spanner, a matching thread is  
25 incised in the curved surface 11a of the seat 11 and facilitates the disconnection of the appendages 5, 6 from the respective seats 11.

      Figures 7 to 10 show spectacles 30 formed in accordance with a first variant of the present invention. Upon the  
30 premise that details similar to those of the previous embodiment are indicated by the same reference numerals, the

frame 2 of the spectacles 30 and hence, in particular, the frame element 4, is made of plastics material.

Moreover, the appendages 5 and 6 extend from the arm 4a in a manner such that the plane they define is substantially parallel to the axis X of the arm 4a and inclined slightly upwards (with reference to the condition of use of the spectacles) relative to the plane defined by the frame element 4 (Figure 9).

The second appendage 6 comprises a first, tooth-like portion 31 integral with the arm 4a and a second, cylindrical portion 32 projecting therefrom in the same direction as and substantially parallel to the first appendage 5. Notches 33 are formed on the curved surface 32a of the second portion 32, on the side remote from the first appendage 5, and extend along parallel and regularly spaced-apart arcs of circles.

The second appendage 6 is housed in a recess 34 in the peripheral edge of the lens 3 so as to constitute means for preventing the lens 3 from rotating about the first appendage 5.

The complementary fixing means of the spectacles 30 comprise a plate 35 made of plastics material, for example, of nylon, in which holes 36, 37 are formed for housing the first and second appendages 5 and 6, respectively. The hole 37 may advantageously be of a size such as to fit the second appendage 6 with interference and to constitute a seat for housing the latter in the sense expressed with reference to the previous embodiment.

Moreover, the edge of the hole 37 is thus at least partially housed in engagement in the notches 33 in order to resist removal of the second appendage 6 from the hole 37.

The complementary fixing means of the spectacles 30 also comprise a bush-like element of the type indicated 10 or 20 above (the latter is shown in Figure 7), which is made of plastics material and which can house the first appendage 5 and can in turn be housed in the hole 36 in the plate 35 and in the hole 7 in the lens 3.

The lens 3 is fixed to the frame element 4 substantially as in the previous embodiment with the difference that the plate 35 is interposed between the bush-like element 10 (or 20) and the lens 3.

It will be noted that, in this embodiment, the seats for housing the appendages 5 and 6, of which the former is defined in the bush-like element 10 (or 20) and the latter is constituted by the hole 37, are fixed together by the plate 35 and by its condition of engagement with the bush-like element 10 (or 20).

In this case, the plate 35 also constitutes an effective element for restraining the arm 4a against bending movements relative to the axis X, the arm 4a having poor bending strength since it is made of plastics material with a thin cross-section.

With the above-described firm fixing between the seats housing the appendages 5, 6 which in turn are fixed firmly to the arm 4a, any bending moments applied to the arm are translated by the plate 35 into tensile stresses which are withstood more effectively by the plastics material.

Figures 11 and 12 show a third embodiment of the spectacles according to the present invention in which details similar to those of the previous embodiments are indicated by the same reference numerals. These spectacles, which are indicated 40 in the drawings mentioned, differ

from the spectacles 30 of the previous embodiment in that the plate 35 is made of metal and has anchoring means for restraining the first appendage 5 in the hole 36 which constitutes the seat for housing the appendage 5. The  
5 anchoring means comprise plate-shaped projections 41 coplanar with the plate and extending radially inwards from the curved surface of the hole 36.

The projections 41 are formed by a series of radial notches formed at intervals in the peripheral region of the  
10 hole 36 and extend into the hole in a manner such that the appendage 5 is housed with interference.

The insertion of the first appendage 5 in the hole 36 causes partial resilient deformation of the projections 41 in the direction of insertion of the appendage. Removal of  
15 the appendage 5 from the hole 36 is thus prevented by the abutment of the projections 41 against the curved surface 5a.

Since the appendage 5 is made of plastics material, the restraint by the projections 41 is rendered extremely  
20 effective by the deformation brought about in the curved surface 5a by incision and/or scratching thereof.

As shown in Figure 11, the appendages 5 and 6 are provided, respectively, with projections 14 and with notches 33 similar to those of the previous embodiment. However, by  
25 virtue of the provision of the above-described anchoring means, the respective curved surfaces 5a, 6a of these appendages may also be smooth.

It will be noted that, in this embodiment, the seats for housing the appendages 5, 6 are constituted by holes 36,  
30 37 in the plate 35 and that the provision of a bush-like element for restraining the respective appendage is

advantageously not necessary. Moreover, the through-hole 7 in the lens 3 may be of a size such that it houses the first appendage 5 with little clearance.

The present invention thus solves the problem posed  
5 with reference to the prior art mentioned, at the same time offering many further advantages, amongst which is the provision of an effective fixing of the lens to the frame without the use of screws, and the fact that it is possible to produce frames with thin cross-sections to improve the  
10 lightweight characteristics of the spectacles. Moreover, the spectacles according to the invention facilitate operations which an optician typically has to perform to disassemble spectacles provided with temporary lenses and subsequently to reassemble them with final lenses.

15 A further advantage is that it is possible to produce sufficiently durable spectacles, even with frames made of plastics material with a small cross-section.

## CLAIMS

1. Improved spectacles, comprising a frame (2), at least one lens (3), and fixing means and complementary fixing means for fixing the lens to at least one element (4) of the frame, the fixing means comprising a first appendage (5) which is fixed to the frame element (4) and can be housed in a through-hole (7) of the lens (3), and characterized in that the fixing means further comprise at least one second appendage (6) fixed to the frame element (4) and spaced from the first appendage (5), and in that the complementary fixing means comprise respective seats (11, 36, 37) for housing the appendages (5, 6), the seats (11, 36, 37) being fixed together in order to restrain the appendages (5, 6) on the side of the lens (3) remote from the frame element (4).

2. Spectacles according to Claim 1 in which a through-hole (8) is provided in the lens (3) and can engage the at least one second appendage (6) in order to restrain the lens (3) with regard to pivoting movements about the first appendage (5).

3. Spectacles according to Claim 1 or Claim 2 in which a respective recess (34) is formed in a peripheral edge of the lens and can engage the at least one second appendage (6) in order to restrain the lens (3) with regard to pivoting movements about the first appendage (5).

4. Spectacles according to one or more of the preceding claims in which the second appendage (6) extends from the frame element (4) substantially parallel to and in the same direction as the first appendage (5).

5. Spectacles according to one or more of the preceding claims, in which at least one of the seats (11, 36, 37) has



a cross-section with dimensions such that the respective appendage (5, 6) is housed in the at least one seat with interference.

6. Spectacles according to one or more of the preceding  
5 claims in which the appendages (5, 6) and the seats (11, 36, 37) define respective curved surfaces (5a, 6a, 11a) which face one another when the appendages are housed in the seats and anchoring means (14, 41) are formed on one and/or on the other of the respective curved surfaces for restraining the  
10 respective appendage in the respective seat.

7. Spectacles according to Claim 6 in which the anchoring means comprise projections (14, 41) formed on at least one of the respective curved surfaces (5a, 6a, 11a) for bringing about plastic deformation of the other of the  
15 respective curved surfaces (11a, 5a, 6a).

8. Spectacles according to Claim 7 in which the projections (14) extend helically along the curved surface (5a, 6a, 11a) to define a screw thread.

9. Spectacles according to Claim 8 in which the screw  
20 thread is formed on the curved surface (5a, 6a) of one of the appendages (5, 6).

10. Spectacles according to Claim 7 in which the projections are plate-shaped projections (41) lying substantially perpendicular to the direction in which the  
25 appendages (5, 6) are inserted in the seats (11, 36, 37) and extending radially from one of the respective curved surfaces towards the other of the respective curved surfaces.

11. Spectacles according to Claims 7 to 10 in which the  
30 projections (14, 41) are formed in only one of the respective curved surfaces (5a, 6a, 11a) and are made of a

material which is harder than the material of the other of the respective curved surfaces.

12. Spectacles according to one or more of the preceding claims, in which the complementary fixing means  
5 comprise at least one bush-like element (10, 20) in which one of the seats (11) is defined, the bush-like element being at least partially housed in engagement in the through-hole (7) of the lens (3) in order to restrain the first appendage (5) in the hole when the first appendage (5)  
10 is housed in the seat (11).

13. Spectacles according to Claim 12 in which the bush-like element (10, 20) is open at a first of its ends (12, 22) in order to house the appendage (5) in the seat (11) and the first end (12, 22) is flush with a principal surface  
15 (3a) of the lens (3) facing the frame element (4) when the bush-like element (10, 20) is housed in the through-hole (7) of the lens (3).

14. Spectacles according to Claim 13 in which the bush-like element (10, 20) is fixed firmly to the other seats  
20 (11) by means of a bridge portion (13) extending from a second, remote end of the bush-like element (10, 20).

15. Spectacles according to one or more of Claims 12 to 14 in which the complementary fixing means comprise a respective bush-like element (10, 20) for each of the  
25 appendages (5, 6).

16. Spectacles according to one or more of Claims 12 to 15 in which the bush-like element (10, 20) is made of plastics material.

17. Spectacles according to one or more of Claims 13 to  
30 16 in which the bush-like element (10, 20) comprises a driving head (21) at an end remote from the first end (12,

22).

18. Spectacles according to one or more of the preceding claims, in which the appendages (5, 6) extend from an arm (4a) of the frame element (4), the arm extending  
5 along a axis (X) substantially parallel to a principal surface (3a) of the lens (3) in order to abut the lens when the first appendage (5) is housed in the through-hole (7) of the lens (3).

19. Spectacles according to Claim 18 in which at least  
10 two of the appendages (5, 6) extend from the arm (4a) in a manner such as to define a plane transverse the axis (X) defined by the extent of the arm in order to restrain the lens (3) with regard to pivoting movements about the axis (X).

15 20. Spectacles according to Claim 18, in which at least two of the appendages (5, 6) extend from the arm (4a) in a manner such as to define a plane substantially parallel to the axis (X) defined by the arm, in order to limit bending movements of the arm (4a).

20 21. Spectacles according to one or more of the preceding claims, in which the frame element (4) is made of wire.

22. Spectacles according to one or more of Claims 1 to 19 in which the frame element (4) is made of plastics  
25 material.

23. Spectacles according to one or more of the preceding claims, in which at least one of the seats (11, 36, 37) for housing the appendages (5, 6) is constituted by a respective hole (36, 37) formed in a plate (35), the plate  
30 being capable of being fixed firmly to the other seats (11, 36, 37).

24. Spectacles according to Claim 23, in which another of the seats (11) is defined in a bush-like element (10, 20) and the plate (35) has a hole (36) for housing the bush-like element (10, 20) in engagement when the appendage (5, 6) is  
5 housed in the bush-element (10, 20).

25. Spectacles according to Claim 22 in which all of the seats (36, 37) for housing the appendages (5, 6) are formed in the plate (35).

26. Spectacles according to one or more of Claims 23 to  
10 25 in which the plate-shaped projections (41) are formed in the curved surface of at least one of the seats by radial notches formed in the plate in the peripheral region of the hole.

27. Spectacles according to one or more of Claims 23 to  
15 26 in which notches are formed in at least one of the appendages housed in a respective hole in the plate, for at least partially housing the edge of the hole.

